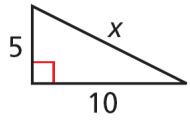
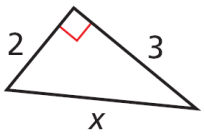
<u>Attendance Problems</u>. Find the value of *x*. Give your answer in simplest radical form.

1.



2.



Simplify each expression.

3. $\frac{12}{\sqrt{3}}$

4. $\frac{\sqrt{20}}{2}$

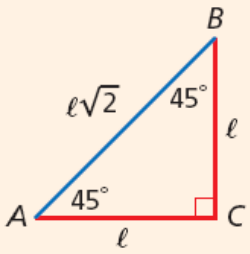
•I can justify and apply properties of 45°-45°-90° triangles.
•I can justify and apply properties of 30°- 60°- 90° triangles.

<u>Common Core</u>: CC.9-12.G.SRT.6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

Theorem 5-8-1 **45°-45°-90° Triangle Theorem**

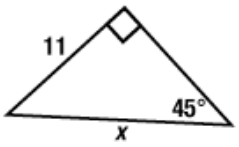
In a 45°-45°-90° triangle, both legs are congruent, and the length of the hypotenuse is the length of a leg times $\sqrt{2}$.

$AC = BC = \ell$ $AB = \ell\sqrt{2}$

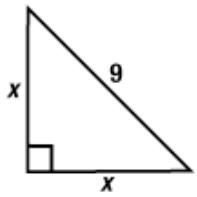


Refer to video example 1. Find the value of x. If necessary, write your answer in simplest radical form.

A.



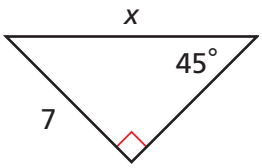
B.



1 Finding Side Lengths in a 45°-45°-90° Triangle

Find the value of *x*. Give your answer in simplest radical form.

A

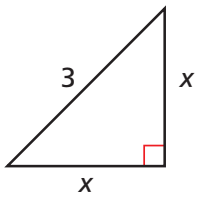


By the Triangle Sum Theorem, the measure of the third angle of the triangle is 45°. So it is a 45°-45°-90° triangle with a leg length of 7.

$x = 7\sqrt{2}$ *Hypotenuse = leg*$\sqrt{2}$

Find the value of *x*. Give your answer in simplest radical form.

B



The triangle is an isosceles right triangle, which is a 45°-45°-90° triangle. The length of the hypotenuse is 3.

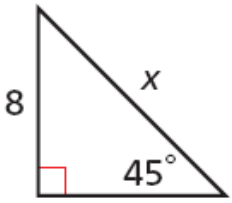
$3 = x\sqrt{2}$ *Hypotenuse = leg$\sqrt{2}$*

$\frac{3}{\sqrt{2}} = x$ *Divide both sides by $\sqrt{2}$.*

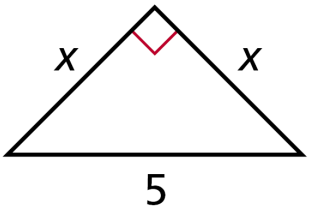
$\frac{3\sqrt{2}}{2} = x$ *Rationalize the denominator.*

<u>Example 1</u>. Find the value of x. If necessary, write your answer in simplest radical form.

A.

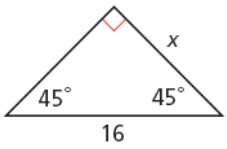


B.

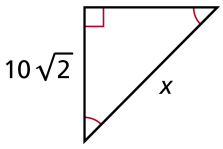


<u>Guided Practice</u>. Find the value of x. If necessary, write your answer in simplest radical form.

5.

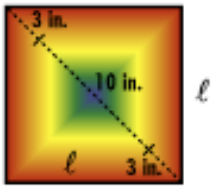


6.



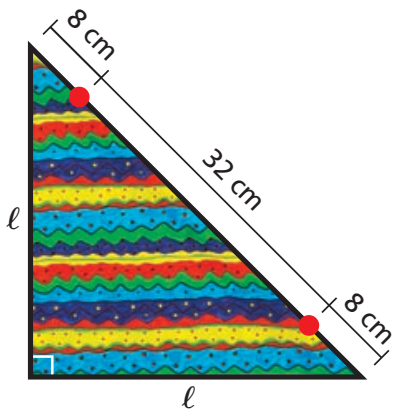
Refer to video example 2.

Tessa wants to make a bandana for her dog by folding a square of cloth into a 45°-45°-90° triangle. Her dog's neck has a circumference of about 10 in. The folded bandana needs to be an extra 6 in. long so Tessa can tie it around her dog's neck. What should the side length of the square be? Round to the nearest inch.



2 Craft Application

Tessa wants to make a bandana for her dog by folding a square of cloth into a 45°-45°-90° triangle. Her dog's neck has a circumference of about 32 cm. The folded bandana needs to be an extra 16 cm long so Tessa can tie it around her dog's neck. What should the side length of the square be? Round to the nearest centimeter.



Tessa needs a 45°-45°-90° triangle with a hypotenuse of 48 cm.

$48 = \ell\sqrt{2}$ *Hypotenuse = leg$\sqrt{2}$*

$\ell = \frac{48}{\sqrt{2}} \approx 34$ cm *Divide by $\sqrt{2}$ and round.*

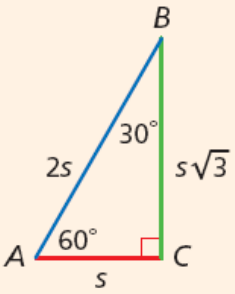
Example 2: Jana is cutting a square of material for a tablecloth. The table's diagonal is 36 inches. She wants the diagonal of the tablecloth to be an extra 10 inches so it will hang over the edges of the table. What size square should Jana cut to make the tablecloth? Round to the nearest inch.

7. Guided Practice. Tessa's other dog is wearing a square bandana with a side length of 42 cm. What would you expect the circumference of the other dog's neck to be? Round to the nearest centimeter.

Theorem 5-8-2 **30°-60°-90° Triangle Theorem**

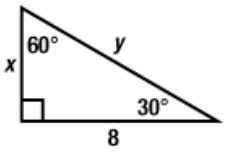
In a 30°-60°-90° triangle, the length of the hypotenuse is is 2 times the length of the shorter leg, and the length of the longer leg is the length of the shorter leg times $\sqrt{3}$.

$AC = s$ $AB = 2s$ $BC = s\sqrt{3}$

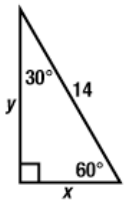


<u>Refer to video example 3</u>. Find the values of *x* and *y*. Give your answers in simplest radical form.

A.



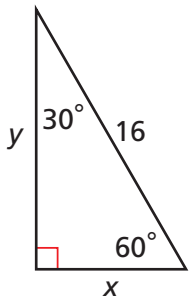
B.



3 Finding Side Lengths in a 30°-60°-90° Triangle

Find the values of x and y. Give your answers in simplest radical form.

A



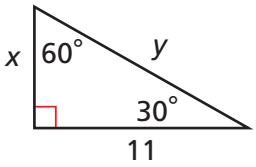
$16 = 2x$ *Hypotenuse = 2(shorter leg)*

$8 = x$ *Divide both sides by 2.*

$y = x\sqrt{3}$ *Longer leg = (shorter leg)$\sqrt{3}$*

$y = 8\sqrt{3}$ *Substitute 8 for x.*

B



$11 = x\sqrt{3}$ *Longer leg = (shorter leg)$\sqrt{3}$*

$\frac{11}{\sqrt{3}} = x$ *Divide both sides by $\sqrt{3}$.*

$\frac{11\sqrt{3}}{3} = x$ *Rationalize the denominator.*

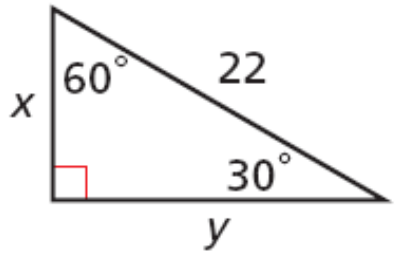
$y = 2x$ *Hypotenuse = 2(shorter leg)*

$y = 2\left(\frac{11\sqrt{3}}{3}\right)$ *Substitute $\frac{11\sqrt{3}}{3}$ for x.*

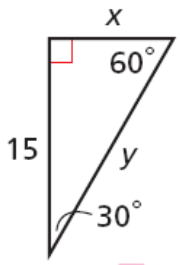
$y = \frac{22\sqrt{3}}{3}$ *Simplify.*

<u>Example 3</u>. Find the values of *x* and *y*. Give your answers in simplest radical form.

A.

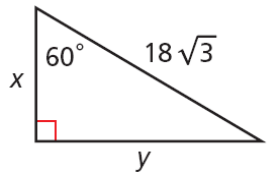


B.

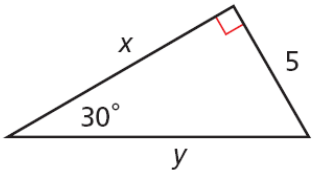


<u>Guided Practice</u>. Find the values of *x* and *y*. Give your answers in simplest radical form.

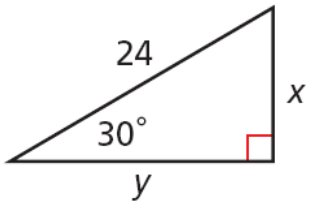
8.



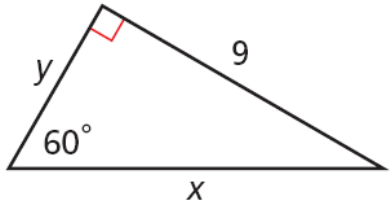
9.



10.

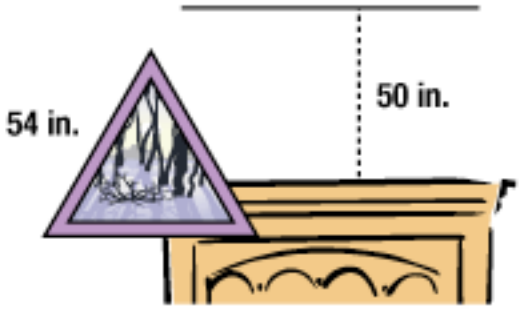


11.



<u>Refer to example 4</u>.

A painting is framed in the shape of an equilateral triangle. The length of one side of the frame is 54 in. Will the painting fit on a wall above the mantle that is 50 in. below the ceiling?

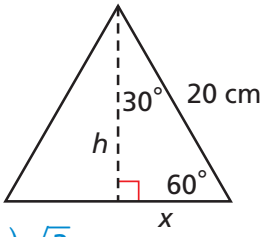


4 Using the 30°-60°-90° Triangle Theorem

The frame of the clock shown is an equilateral triangle. The length of one side of the frame is 20 cm. Will the clock fit on a shelf that is 18 cm below the shelf above it?

Step 1 Divide the equilateral triangle into two 30°-60°-90° triangles.

The height of the frame is the length of the longer leg.



Step 2 Find the length x of the shorter leg.

$20 = 2x$ *Hypotenuse = 2(shorter leg)*

$10 = x$ *Divide both sides by 2.*

Step 3 Find the length h of the longer leg.

$h = 10\sqrt{3} \approx 17.3$ cm *Longer leg = (shorter leg)$\sqrt{3}$*

The frame is approximately 17.3 centimeters tall.
So the clock will fit on the shelf.

Example 4. An ornamental pin is in the shape of an equilateral triangle. The length of each side is 6 centimeters. Josh will attach the fastener to the back along AB. Will the fastener fit if it is 4 centimeters long?

12. <u>Guided Practice</u>. A manufacturer wants to make a larger clock with a height of 30 centimeters. What is the length of each side of the frame? Round to the nearest tenth.

<u>5-8 Applying Special Right Triangles</u> (pp 372-373) 10-18, 20, 23, 26, 29.